

1. A process for isolating devices on a semiconductor substrate comprising the steps of:

removing predetermined portions of the semiconductor substrate forming recesses therein; and

refilling the portions of the semiconductor substrate with a material having a dielectric constant lower than the dielectric constant of silicon dioxide.

- 2. The process of Claim 1, wherein the step of removing portions of the semiconductor wafer comprises forming trenches in the semiconductor wafer.
- The process of Claim 2, wherein the trenches have a depth of less than 200 nm.
- 4. The process of Claim 3, wherein the trenches have an aspect ratio of less than 2:1.
- 5. The process of Claim 1, wherein the material having a dielectric constant lower than that of silicon dioxide comprises a halide-doped silicon dioxide composition.
- 6. The process of Claim 5, wherein the halide-doped silicon dioxide complex comprises a Fluorine-doped silicon dioxide complex.
- 7. The process of Claim 1, wherein the refilling material has a dielectric constant less than about 3.9.
- 8. The process of Claim 1, further comprising forming a barrier layer over the semiconductor substrate prior to the step of refilling portions of the semiconductor substrate.
- 9. The process of Claim 8, wherein the barrier layer comprises a silicon dioxide composition.
- 10. The process of Claim 8, wherein the barrier layer comprises a silicon nitride composition.

An isolation structure in a semiconductor substrate comprising:

a recessed portion formed therein in the semiconductor substrate; and

a dielectric material filling the recessed portion, said dielectric material having a dielectric constant lower than the dielectric constant of silicon dioxide.

30

25

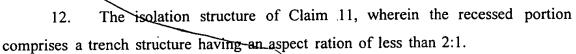
5

10

15

20





- 13. The isolation structure of Claim 11, wherein the recessed portion comprises a trench structure having a depth of less than 200 nm.
- 14. The isolation structure of Claim 11, further comprising a barrier layer disposed between the recessed portion of the semiconductor substrate and the dielectric material.
- 15. The isolation structure of Claim 11, wherein the dielectric material has a dielectric constant lower than 3.9.
- 16. The isolation structure of Claim 11, wherein the dielectric material comprises a Fluoride-doped silicon dioxide composition.
- 17. A method of reducing the formation of voids in a refilled trench isolation process comprising the steps of:

forming trenches having an aspect ratio less than 2:1; and

refilling the trenches with a material having a dielectric constant less than the dielectric constant of silicon diposide.

- 18. The method of plaim 17, wherein the trenches have a depth of less than 200 nm.
- 19. The method of Claim 17, wherein the refilling material comprises a Fluorine-doped silicon dioxide composition.
- 20. The method of Claim 17, wherein the refilling material has a dielectric constant of less/than about 3.9.

25

20

5

10

15